PATENT
Docket No.: M4065.0069/P069

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Garo J. DERDERIAN

Serial No.: 09/121,528

Filed: July 23, 1998

For: CONTINUOUS GOOD STEP COVERAGE CVD PLATINUM METAL DEPOSITION

Group Art Unit: 1762

Examiner: T. Meeks

#10 CNE
3/13/00
MW

Assistant Commissioner for Patents
Washington, D.C. 20231

RESPONSE TO FINAL OFFICE ACTION

Dear Sir:

This is in response to the Final Office Action dated October 29, 1999. The period for response has been extended up to and including February 29, 2000 by the one-month extension of time submitted herewith.

REMARKS

Claims 1-4, 6-10, 12-36 and 46-55 are pending in this application.

Claims 1-4, 6-10, 12-36 and 46-55 stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Baum et al. (U.S. Patent No. 5,783,716) in view of Kwon et al. (Applied Physics Letters) and Chen et al. (Applied Physics Letters). The rejection is respectfully traversed.

The claimed invention relates to a method for depositing a platinum based metal film by CVD deposition. A non-reactive gas is bubbled over an organic platinum based metal precursor until the non-reactive gas is saturated with the precursor. The platinum based metal film is then deposited onto a substrate in a CVD deposition chamber in the presence of both oxygen (O_2) and nitrous oxide (N_2O) at a predetermined temperature and under a pressure of from about 10 to about 1000 Torr. The resulting film is consistently smooth and has good step coverage.

Baum et al. ("Baum") relates to a liquid delivery for the transport of a platinum source reagent to a CVD reactor using a source reagent liquid solution, which is volatilized to provide a vapor phase platinum source material for subsequent deposition from the vapor in the CVD reactor of platinum. Baum uses the liquid solution precursor optionally in the presence of an oxidizing gas such as oxygen, ozone, nitrous oxide and mixtures thereof in a platinum CVD deposition process. (Col. 5, lines 16-27). Baum is silent as to the operating conditions of the liquid delivery apparatus to be used in a CVD process and only recites that the liquid delivery eliminates "the deleterious effects of having oxygen in contact with capacitor oxides at high temperatures (i.e., ≥500°C)." (Col. 5, lines 1-3).

The Office Action concedes that Baum does not disclose a pressure. Nevertheless, to overcome the shortcoming of Baum, the Office Action relies upon Kwon et al. ("Kwon"), which teaches a pressure of 2 Torr in the CVD deposition of platinum, and upon Chen et al. ("Chen"), which teaches platinum deposition at 760 Torr (atmospheric pressure). In this respect, the Office Action concludes that "it would have been obvious to have used deposition pressures in this range (2 Torr to atmospheric (760 Torr)) which overlaps with the claimed ranges because these deposition pressures would have been expected to be effective for depositing the platinum films by CVD with these precursors." (Office Action at 3). The Applicant disagrees.

The claimed invention is not obvious over Baum in view of Kwon and Chen. First, Baum is silent as to the operating pressure of the CVD apparatus. Second, even if Kwon recites a deposition pressure of 2 Torr, Kwon does not disclose or suggest that the

platinum deposition be conducted in the presence of oxygen and nitrous oxide as presently claimed. Thus, even if Kwon might suggest a platinum deposition at a pressure within the claimed range, Kwon still does not suggest the claimed chemistry, which is the mixture of oxygen and nitrous oxide, or that the pressure used in Kwon would be applicable to the claimed chemistry. Third, Kwon does not teach or disclose a pressure other than 2 Torr.

Similarly, Chen recites a deposition pressure of 760 Torr, but does not disclose or even suggest that the platinum deposition be effectuated in the presence of oxygen and nitrous oxide. In fact, Chen teaches a completely different mixture, that is argon and hydrogen flown over a hot substrate. Further, Chen does not teach or disclose a pressure other than the atmospheric pressure and, again, Chen does not suggest that his pressure could be used with the specifically claimed chemistry. Thus, although Kwon and Chen arguably teach platinum deposition at very specific pressures, it is clear that Kwon and Chen do not teach or suggest that such pressures would be at all useful with the claimed chemistry.

Moreover, Kwon and Chen disclose entirely different chemistries from that employed in Baum. As such, there is no teaching or suggestion in any of these references for the claimed subject matter. The references are also not combinable in view of the diverse chemistries involved in each reference. It is clear, therefore, that the rejection is based on picking and choosing selected portions of each reference, without regard to the totality of teachings of the references, in an attempt to improperly use hindsight to reconstruct the invention. Accordingly, a person of ordinary skills in the art could not have been motivated to combine Baum with Kwon and Chen, and withdrawal of this rejection is respectfully requested.

The Office Action further asserts that Kwon and Chen suggest a range for the platinum deposition pressure, that is 2 Torr to 760 Torr. The Applicant disagrees.

Kwon does not suggest or disclose a deposition pressure other than a low pressure such as 2 Torr. Kwon addresses the dependency between the microstructure and

electrical properties of platinum films on one hand, and the various deposition conditions, such as temperature, on the other hand. Kwon analyses the impact of only two deposition parameters (temperature and oxygen flow rates) on the nucleation and growth rates of platinum films. For example, according to Kwon, at a 50 sccm oxygen flow rate, "[P]latinum films deposited at 300 and 350°C showed a random orientation, but above 400°C the preferred orientation was (111)." (Kwon at 3). With respect to pressure, Kwon mentions only once that "the Pt source was vaporized at reduced pressure (2 Torr). (Kwon at 1). Kwon is silent on the impact, if any, of different pressures on the Pt film properties. More important, Kwon is silent on whether any variation in the deposition pressure could have any effect on the nucleation and growth rates of the Pt film. Thus, Kwon does not disclose or even suggest in any way a range of deposition pressures for which Kwon's experimental data would be valid.

Similarly, Chen does not disclose or suggest a deposition pressure other than 760 Torr (atmospheric pressure). Chen analyses only the impact of low temperatures on an atmosphere of hydrogen on the deposition of polycrystalline films of platinum. The experiment in Chen involves using toluene instead of benzene as the solvent, with the reaction starting at - 77°C and the substrate being held at 180°C. Chen mentions that "[T]he complex was vaporized at atmospheric pressure and 25°C into a stream of flowing argon." However, atmospheric pressure and a temperature of 25-27°C are standard conditions, and Chen does not suggest in any way any range of pressure, and certainly not a lower than 760 Torr pressure that would work with low temperature and toluene, and not the conventional benzene as solvent. Undoubtedly, Chen is silent on any range of very low pressures, such as a range including a pressure of 2 Torr. Thus, Kwon and Chen together do not suggest any range for the deposition pressure, and certainly not a range of 2 Torr to 760 Torr.

Thus, Baum in view of Kwon and Chen does not disclose or suggest the CVD deposition in the presence of oxygen and nitrous oxide "at a pressure of from about 10 to about 1000 Torr" (amended claim 1), or at pressure in ranges such as "from about 15 to

about 30 Torr" (added claim 47) or "from about 10 to about 50 Torr) (added claim 46). Accordingly, claims 1-4, 6-10, 12-36 and 46-55 are patentable over Baum in view of Kwon and Chen.

Claims 1-4, 6-10, 12-36 and 46-55 stand rejected under 35 U.S.C. § 103 as being unpatentable over Kwon in view of Baum and Chen. The rejection is respectfully traversed.

Kwon teaches a pressure of 2 Torr in the CVD deposition of platinum by bubbling argon over a platinum precursor. As conceded by the Office Action, Kwon does not disclose or suggest that the platinum deposition be conducted in the presence of oxygen and nitrous oxide as presently claimed. Furthermore, Kwon does not teach or disclose a pressure other than 2 Torr. Nevertheless, to overcome this shortcoming in Kwon, the Office Action relies upon Baum to teach a mixture of oxidizing agents which may include oxygen and nitrous oxide. However, Baum cannot suggest in any way to modify Kwon simply because Baum is completely silent on the deposition pressure and uses a different chemistry. The Office Action also relies on Chen to teach a platinum deposition at atmospheric pressure (760 Torr). But, Chen is not concerned with any variation in the deposition pressure and his chemistry is different from those of Baum and Kwon. As explained above, Chen merely lists the 760 Torr pressure, along with the room temperature of 25°C, as standard operating parameters. There is nothing in Chen to even suggest that a low pressure may, or could, work with toluene as solvent under a very low temperature of -77°C. Thus, Baum and Chen do not disclose or suggest how to modify Kwon to attain the claimed invention.

In short, there is nothing in this combination of references, without the improper use of hindsight reconstruction, to motivate a person having ordinary skill in the art to arrive at the instantly claimed method.

In view of the foregoing remarks, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

February 28, 2000

Respectfully submitted:

By:_____

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